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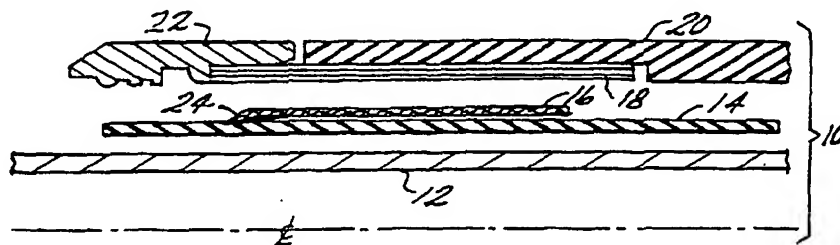
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(54) Title: EXTRUSION RESISTANT INFLATABLE TOOL



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(57) Abstract: Extrusion resistant inflatable tool having a biaxially oriented woven material disposed about at least one elastomeric element of the inflatable tool and radially inwardly of a rib structure of the inflatable tool. The woven material prevents extrusion of the elastomeric element between individual ribs of the ribs structure during the inflation of the tool.

EXTRUSION RESISTANT INFLATABLE TOOLCROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of an earlier filing date from U. S. Provisional Application Serial Number 60/144,508.

BACKGROUND OF THE INVENTION

## Field of the Invention

The invention relates to downhole oil field tools. More particularly, the invention relates to performance enhancing devices for inflatable elements.

## Prior Art

Inflatable elements such as packers have been known and used in the hydrocarbon production industry for a substantial period of time. During this time they have been reliable and favored by oil well operators in many sealing operations. Prior art inflatable elements have however had difficulty with setting in noncylindrical boreholes. Noncylindrical boreholes include oval boreholes, unconsolidated boreholes, windows, etc. The problems of the prior art inflatable elements in noncylindrical boreholes has been that the rubber of the inflatable boot is extruded through the ribs of the element. This can cause severe damage to the rubber of the boot and to the ribs of the element and may result in failure of the device. Thus, the art is in need of a means to avoid extrusion of the rubber boot of the inflatable element through the rib portion of the inflatable element during inflation of a tool in a noncylindrical environment.

SUMMARY OF THE INVENTION

The above-identified drawbacks of the prior art are overcome or alleviated by the extrusion resistant inflatable tool of the invention.

In the invention, a biaxially woven sleeve is interposed between the boot/inner-tube and the ribs of a tool having otherwise conventional components. The sleeve is preferably constructed of carbon fiber, aramid fiber, fiber glass or suitable alternative fiber which

provides a bridge between the ribs of the inflatable tool as the element expands into the noncylindrical environment. The existence of the biaxially woven sleeve in an annular area outside the boot and inside the ribs of the element prevents the boot from being extruded through the ribs when they open excessively during expansion into a noncylindrical borehole environment. The sleeve further prevents excessive bending of the ribs which would otherwise create difficulties in removing the tool from the downhole environment.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the drawings wherein like elements are numbered alike in the several FIGURES:

FIGURE 1 is a schematic cross section of the device of the invention illustrating the position of the extrusion resistant biaxially woven sleeve;

FIGURE 2 is a view of the sleeve itself illustrating the pattern thereof;

FIGURE 3 is an illustration of the sleeve disposed around the rubber boot; and

FIGURE 4 is an illustration of a sleeve around the rubber boot after inflation and deflation.

#### DETAILED DESCRIPTION OF THE INVENTION

Referring to Figure 1, one of ordinary skill in the art will recognize the typical cross section of an end assembly of an external casing packer (ECP) 10. Within the ECP 10, a mandrel 12 is disposed at the inside diameter of the tool. Radially outwardly of mandrel 12 is an expandable boot/inner-tube 14, which most commonly is constructed of rubber, although other expandable materials may be employed as desired.

Located radially outwardly of boot 14 is an extrusion resistant biaxially woven sleeve 16, which is critical to the functionality of the invention. The sleeve 16 is interposed between the boot 14 and ribs 18 which are mounted within the outer cover 20 and end sleeve 22 of the tool of the invention. Ribs 18 are constructed and overlapped according to industry standards, known to one of ordinary skill in the art. Upon expansion of boot 14, in a noncylindrical shaped borehole environment, ribs 18 expand beyond the intended amount and subject the tool to damage. The distorted ribs 18, even after deflation of the inflatable tool may hinder removal of the tool from the borehole costing both time and money. The interposition of sleeve 16, between boot 14 and ribs 18 provides an effective bridge between

the ribs when they open upon inflation, which is sufficient to retain boot 14 and prevent extrusion thereof through ribs 18. Sleeve 16 is about 18" long and is located substantially over the intersection between end sleeve 22 and rubber outer cover 20 to prevent the deformation of ribs 18 as well as the extrusion of boot 14.

Sleeve 16 may preferably be constructed of carbon fiber or aramid fiber (or kevlar), fiberglass or other similar fiber material having comparable properties. It is noted that the stronger fibers, i.e. carbon, kevlar are preferred.

In construction of the device of the invention referring to figure 3, the uphole end 24 of sleeve 16 is tightly wrapped about boot 14 and generally does not move from its original location. In order to allow the sleeve 16 to expand however, it is preferable to wrap boot 14 with Teflon tape or other similar friction reducing material under all but the uphole end 24 of sleeve 16. The sleeve 16 is commercially available from A&P Technology, Covington, Kentucky.

Figure 4 illustrates the condition of the sleeve after inflation of boot 14 and deflation thereof. Although damage is notable on the sleeve, it is also apparent that the boot 14 did not extrude through the ribs of the inflatable device. Thus, the construction of the device of the invention overcomes the prior art difficulty of a rubber boot being extruded through the ribs of the inflatable device during inflation in a noncylindrical borehole environment.

## CLAIMS:

What is claimed is:

1. An inflatable tool comprising:  
a mandrel;  
an inflatable element disposed about said mandrel; and  
an extrusion resistant mechanism disposed about said element.
2. The inflatable tool of claim 1, wherein said tool further comprises a plurality of ribs disposed about said antiextrusion mechanism.
3. The inflatable tool of claim 2, wherein said antiextrusion mechanism is a woven material.
4. The inflatable tool of claim 3, wherein said woven material is biaxially woven.
5. The inflatable tool of claim 3, wherein said material is one of carbon fiber, Aramid fiber and fiberglass.
6. The inflatable tool of claim 1, wherein said tool further includes a friction lowering material disposed between said antiextrusion mechanism and said inflatable element.
7. The inflatable tool of claim 6, wherein said friction lowering material is applied to said element.
8. The inflatable tool of claim 7, wherein said friction lowering material is Teflon tape.
9. The inflatable tool of claim 6, wherein said friction lowering material is applied to said antiextrusion mechanism.
10. The inflatable tool of claim 1, wherein said antiextrusion mechanism is composed substantially of material having a low coefficient of friction.

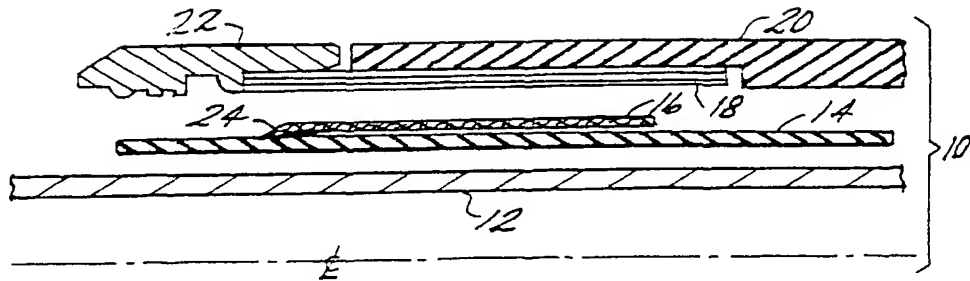


FIG. 1

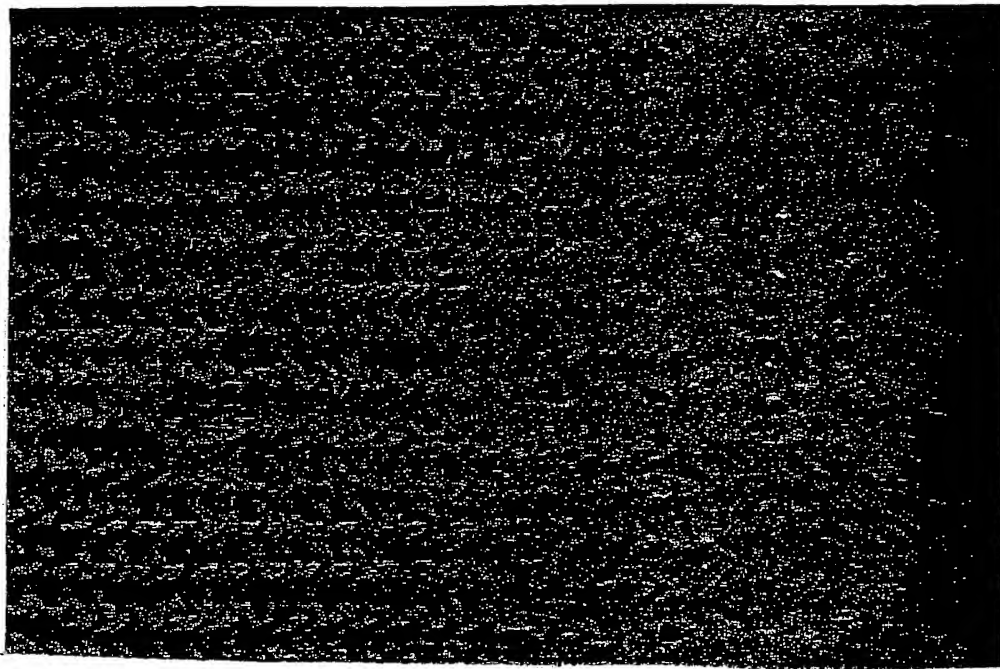


FIG. 2

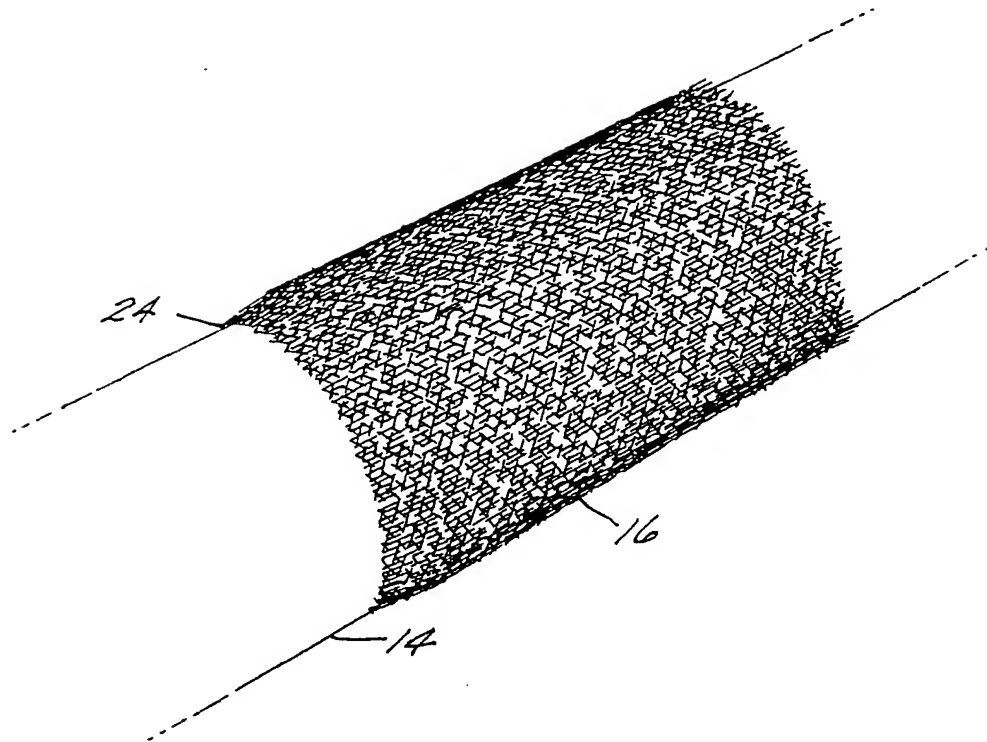


FIG. 3

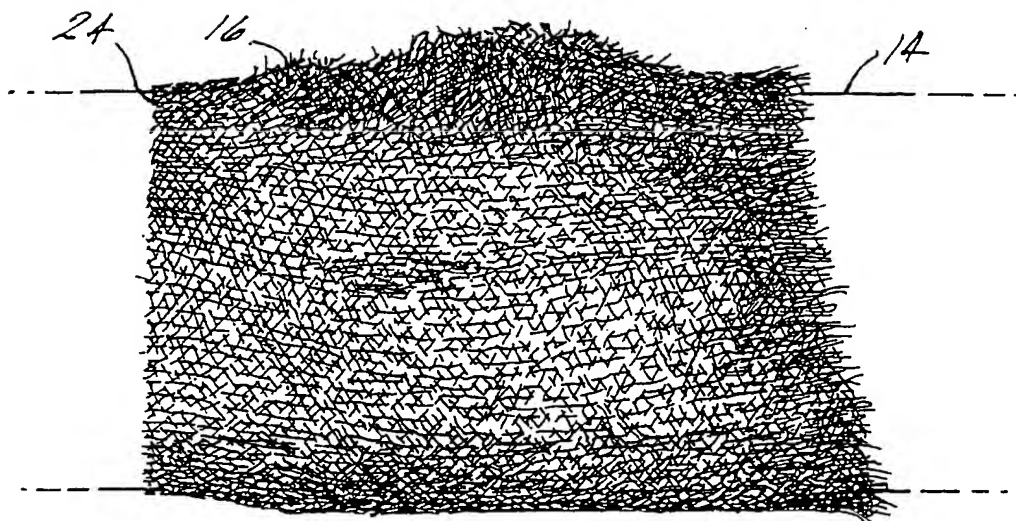


FIG. 4

# INTERNATIONAL SEARCH REPORT

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<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 7 E21B33/12 E21B33/127		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC 7 E21B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
Date of the actual completion of the international search 17 October 2000		Date of mailing of the international search report 24/10/2000
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer Fonseca Fernandez, H



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